Work and Kinetic Energy

Pre-Class Questions

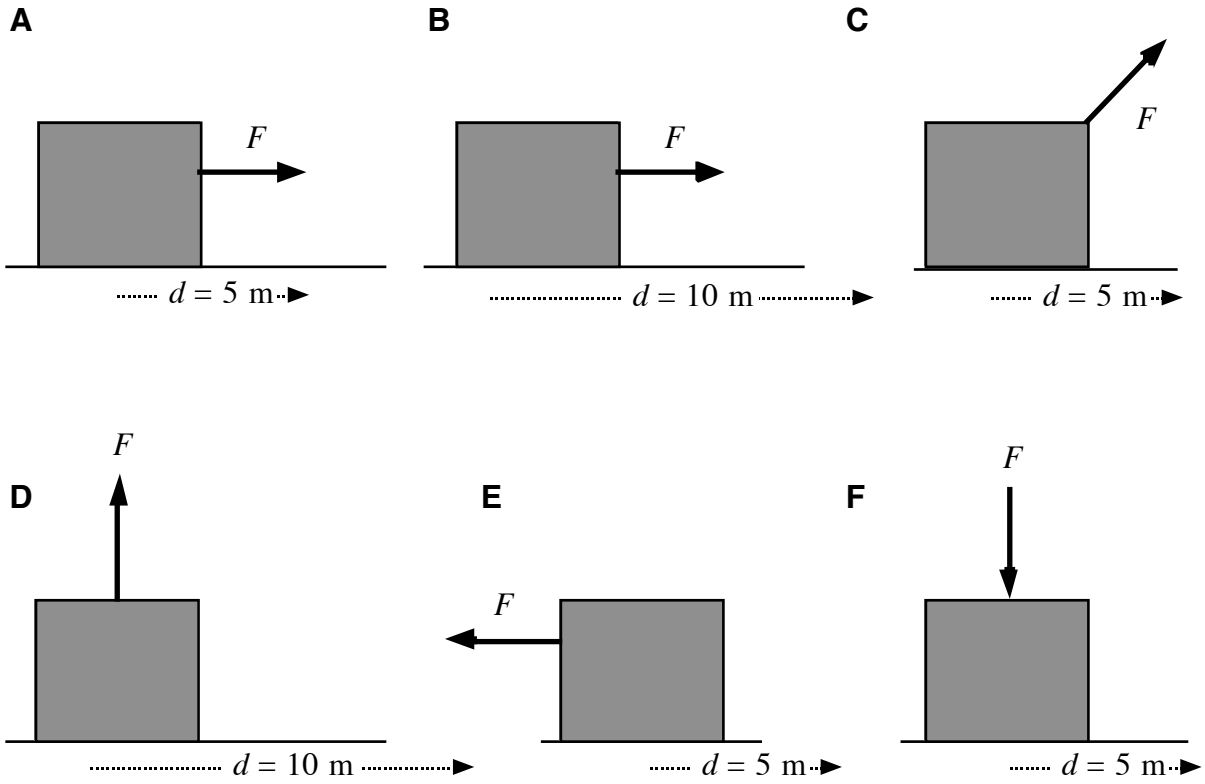
Problem Set (due next time)
Ch 7 – 3, 5, 17, 22

Lecture Outline

1. The Work Done by a Constant Force
2. The Work-Energy Theorem

In the figures below, identical boxes of mass 10 kg are moving at the same initial velocity to the right on a flat surface. The same magnitude force, F, is applied to each box for the distance, d, indicated in the figures.

Rank these situations in order of the work done on the box by F while the box moves the indicated distance to the right.



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

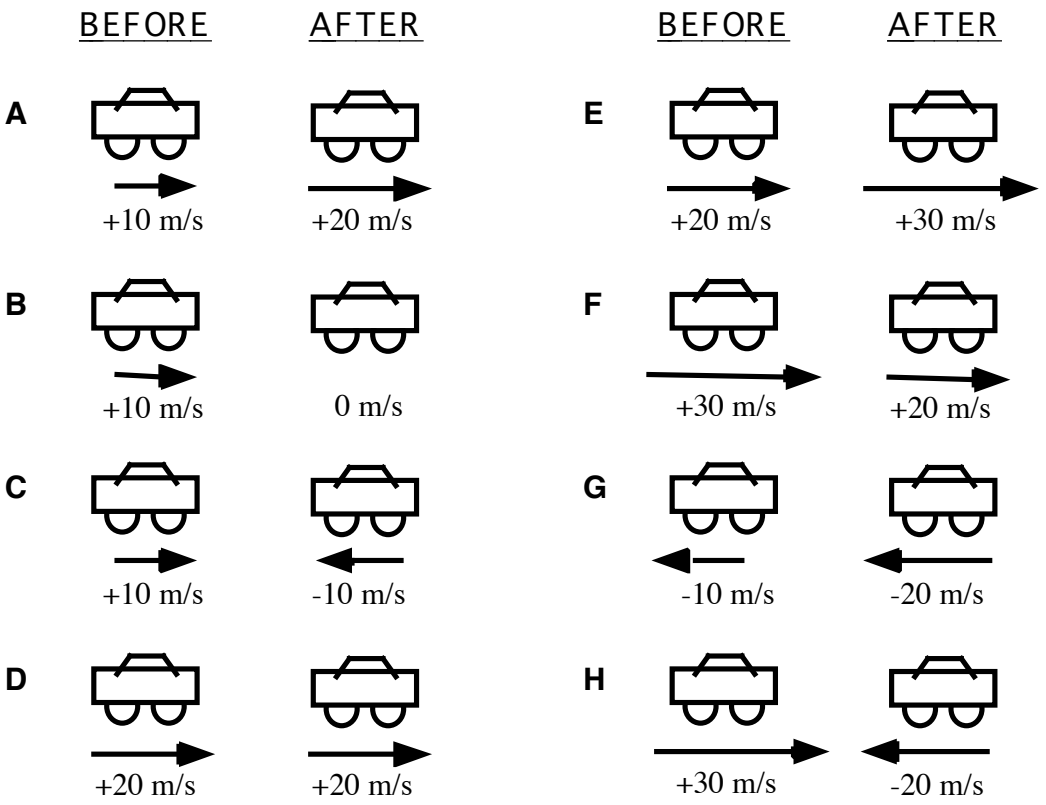
Or, all of the boxes experience the same work. _____

Please carefully explain your reasoning.

Example 1: A 50N force is exerted at 30° above horizontal on a 20kg suitcase. The suitcase moves at a constant speed for 4.0m. Find the work done by each force that acts on it.

Example 2: Repeat example 1 assuming the frictional force on the suitcase is only 34N.

The eight situations below show *before* and *after* "snapshots" of a car's velocity. Rank these situations, in terms of the change in kinetic energy of these cars, from most positive to most negative. All cars have the same mass and have traveled the same distance during this change. Negative numbers, if any, rank lower than positive ones (-20 m/s < -10 m/s < 0 < 5).



Most Positive 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ 7_____ 8_____ Most Negative

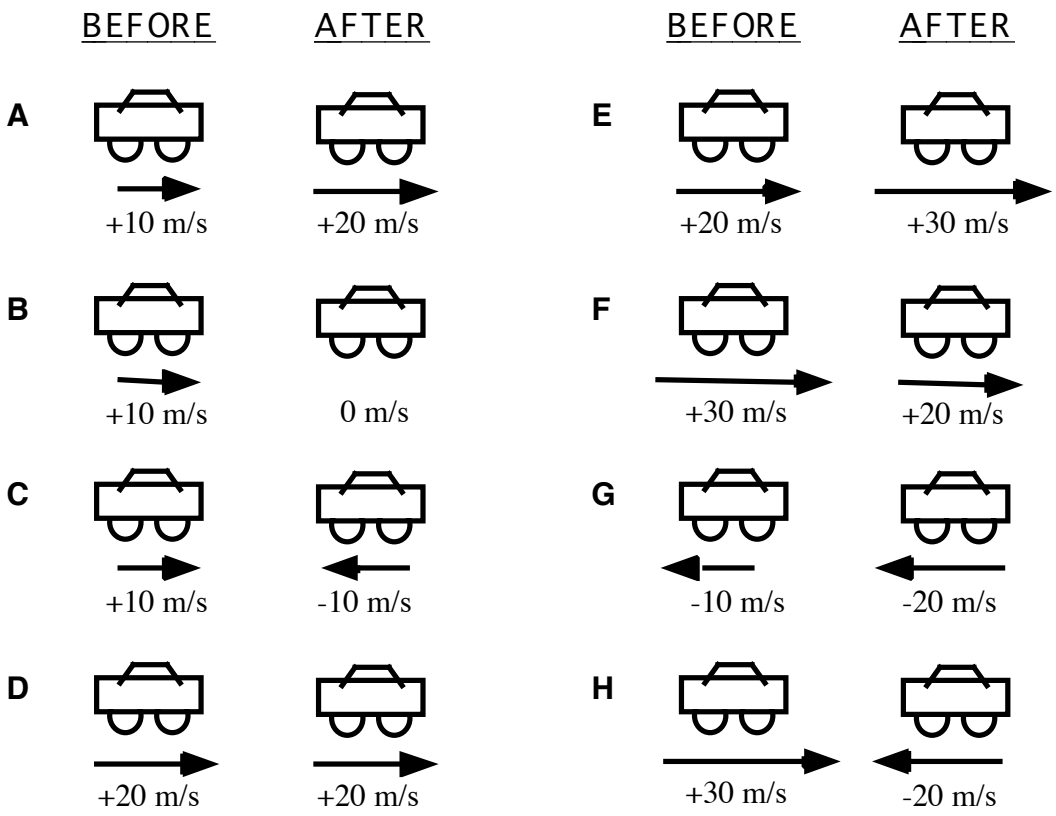
Or, the change in kinetic energy is the same (but not zero) for all of these cases. _____

Or, the change in kinetic energy is zero for all of these cases. _____

Or, it is not possible to determine the change in kinetic energy for these cases. _____

Please carefully explain your reasoning.

The eight situations below show *before* and *after* "snapshots" of a car's velocity. Rank these situations, in terms of work done on the car, from most positive to most negative, to create these changes in velocity for the same distance traveled. All cars have the same mass. Negative numbers, if any, rank lower than positive ones (-20 m/s < -10 m/s < 0< 5).



Most Most
Positive 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ 7_____ 8_____ Negative

Or, the work done on the cars is the same (but not zero) for all of these. _____

Or, the work done on the cars is zero for all of these. _____

Or, it is not possible to determine the work done on the cars for all these cases. _____

Please carefully explain your reasoning.

Example 3: A ball is dropped from a height of 1.00m. Find the speed just before it strikes the ground.

Lecture 16 - Summary

The Definition of Work $W \equiv F_{\|} s$

Only the part of the force along the displacement counts.

The Definition of Kinetic Energy $K \equiv \frac{1}{2} m v^2$

Work-Energy Theorem $W_{net} = \Delta K$